sometimes be removed in this way; but if we consider that a greatly increased supersaturation (six-fold instead of four-fold) is necessary, and that the production of ions is continually going on, so that negative ions as well as positive are always present, we can hardly consider it a likely occurrence. What then is the subsequent history of the positive ions after being carried up out of reach of the drops formed on the negative ions? They will, under the action of the electric field produced by this separation, tend to travel downwards relatively to the air with a velocity of the order of one centimetre per second for a field of 100 volts per metre, as the measurements of Rutherford and others have shown. After being carried beyond the region of ascending air-currents, they will travel downwards towards the earth's surface; but long before reaching it they will become attached to cloud particles or to the dust particles of the lower layers of the atmosphere, where the positive charge will accumulate.

It is not claimed that the process described above is the only source of rain or the only source of atmospheric electricity. It should be pointed out, for example, that another way in which rain may possibly acquire a negative charge is by falling through ionised air. For according to Zeleny (*Phil. Mag.* vol. xlvi. p. 135) a body suspended in a current of ionised air becomes negatively charged in virtue of the slightly greater velocity of the negative than of the positive ion under a given force. Elster and Geitel make use of this difference between the positive and negative ions to account for the normal positive electrification of the atmosphere, by the passage of air through the vegetation on the earth's surface. Whether, however, the charged particles, the presence of which near the surface of the earth their experiments seem to prove, are really free ions whose velocity under a given force is that of the ions produced by Röntgen and other rays and not comparatively slow-moving masses (the nuclei called dust particles by Mr. Aitken) to which ions have attached themselves remains as yet undecided. In air charged with dust even to the extent to which clear air near the surface of the ground is shown by Mr. Aitken's observations to be, it is likely, since the rate of ionisation in the atmosphere is certainly slow, that an ion would become attached to some dust particle in a time very short compared with what the average life of an ion would be in dust-free air, where it is determined merely by the rate of recombination of the ions.

In conclusion, it must be confessed that if the rate at which the electric field of the earth is being destroyed by leakage through the air is anything like so great as is given by Elster and Geitel's interpretation of their experiments (*i.e.* of the order of 1 per cent. per minute), no theory which attributes the normal fine weather electricity to the effect of precipitation at a distance is sufficient to explain the facts. C. T. R. WILSON.

Cambridge Laboratory, Cambridge, May 16.

Specimens of "Dromæus ater."

IN reference to Prof. Giglioli's note (*supra*, page 102), I may perhaps be allowed to remark that Bullock's Museum appears to have contained a specimen of the extinct *Dromaeus ater*. The twelfth edition of the "Companion" to that Museum, published in 1812, has the following entries (page 80):—

"Great Emeą, or New Holland Cassowary . . .

"Lesser Emeą, not half the size of the above, and a distinct species."

At the dispersal of his collection the sale Catalogue includes both specimens as lots 97 and 98 on the eleventh day of the sale (May 18, 1819), the latter as

"Lesser Emeẏ, a distinct species from the last,"

and my annotated copy of the Catalogue shows that both were bought by the Linnean Society—for 10*l.* 10*s.* and 7*l.* 10*s.* respectively. I have tried to trace the latter specimen, but in vain. It may still exist unrecognised. ALFRED NEWTON.

Magdalene College, Cambridge, June 4.

Effect of Iron upon the Growth of Grass.

SOME years ago NATURE published a short letter of mine from India, noticing the way in which laying out iron (famine) tools on the ground brought on grass upon very dry surfaces. Any one who looks now under the rows of iron chairs, and round the railings, of the band-stand on the east side of the Green Park, will see the same stimulating effect produced. A. T. F.

London, June 4.

SOURCES AND PROPERTIES OF BECQUEREL RAYS.

IN the following article a general account is given of a few of the more striking phenomena connected with Becquerel rays, including some of the recent developments of the subject at the hands of Becquerel, M. and Mme. Curie and others.

Among a large number of papers which have lately been published, dealing with properties of these rays, two are worthy of especial notice, as giving a comprehensive view of the phenomena. For those who propose to study the subject more fully, no better guide can be found than Prof. Elster's report in Eder's *Jahrbuch für Photographie und Reproductionstechnik* for 1900. The footnote references to original papers form a complete bibliography of the literature of the subject existing at the time when the article appeared, and it is surprising that Prof. Elster should have succeeded in summarising so large an amount of matter in eleven very small pages. Dr. B. Walter's article in the *Fortschritte auf dem Gebiete der Röntgenstrahlen* is somewhat less condensed and more popular; the chief phenomena, especially the photographic and fluorescent properties, are dealt with at greater length, and the article is illustrated by a plate of radiographs showing the difference between the actions of Becquerel and Röntgen rays. Already Walter's paper, and, to a less degree, Elster's report, have become out of date on the subject of magnetic deviation, and for this and other later developments no better guide could be found than the well-condensed summaries contained in the current monthly parts of *Science Abstracts*.

The discovery of these rays in 1896 was a natural sequence of the discovery of the Röntgen rays, and was led up to, on the one hand, by the attempts of M. Henry to intensify the action of Röntgen rays by the use of phosphorescent substances; and, on the other hand, by the theory, since abandoned, that the Röntgen rays were themselves the result of phosphorescence of the vacuum tube. Becquerel and other physicists made numerous experiments to test whether phosphorescent substances emitted rays capable of acting on a photographic plate that was enveloped in opaque paper, and it was found that rays which produce actinic action were emitted by the phosphorescent salts of uranium, not only when these salts had been exposed to the action of sunlight or of Röntgen rays, but even after they had been kept in the dark for months, the "radio-activity" showing no perceptible falling off.

The next step was the discovery, by Mme. Curie, that Bohemian pitch-blende—a black, shiny ore of uranium—possessed a higher degree of radio-activity than uranium itself, and this result naturally suggested the view that the ore contained, besides uranium, some other substance to whose presence the increased action was due. By separating the pitch-blende into its constituents, M. and Mme. Curie were led to discover the existence of two sources of radio-activity, one associated with the compounds of bismuth, and the other with those of barium occurring in the ore. Seeing that barium and bismuth obtained from other sources do not emit Becquerel rays, these radiations were attributed to the existence of two new substances, that associated with bismuth being named polonium, a name derived from the Polish nationality of Mme. Curie, while the other substance associated with barium chloride was called radium. The separation of these two substances has led to the production of rays of sufficient intensity to excite fluorescent screens, discharge electrified conductors, and, indeed, to reproduce, with differences, most of the properties of Röntgen rays. A third radio-active substance, produced from the residues of pitch-blende, is recorded by Debierne, who names it actinium. It is precipitated by the principal agents for titanium, and it